CAPTAN
Ecological Effects
Topical Summaries

Effects on Birds

Fifteen studies (contained in eleven references) were received and evaluated under this topic. Thirteen studies are acceptable for use in hazard assessment, and two studies are unacceptable.

Studies Received and Evaluated

Author	Date	Fiche ID
Beavers, J.	1985	BAOCAP18
Hudson et al.	1984	HCOSTA01
Schafer, E.	1972	00020560
Hill, et al.	1975	00022923
Wildlife International	1978	BAOCAP02
Fink et al.	1980	00104686
Chevron Chemical (Fink, R.)	1980	00098295
Chevron Chemical (Fink, R.)	1980	00098296
Stromberg, K.	1975	00104083
Dickhaus and Heister	1983	BAOCAP13 Invalid
Dickhaus and Heister	1984	BAOCAP14

To establish the toxicity of captan to birds, the following tests are required using the technical grade material:

a. one avian single-dose oral study on either a water fowl species (preferably mallard duck) or an upland species (preferably bobwhite quail or ring-necked pheasant);

b. Two subacute dietary studies: one study on a species of upland game birds (preferably bobwhite quail or ring-necked pheasant) and one study on a species of water fowl (preferably mallard duck).

The acceptable acute oral toxicity studies are listed below.

Species	% ai	LD_{50} (95% ci)	Author	Date	ID	Fulfills Guidelines Requirements?
Colinus virginianus	Tech.	> 2150 mg/kg	Beavers	1985	BAOCAP18	Yes
Anas platyrynchos	Tech.	> 2,000 mg/kg	Hudson et al.	1984	HCOSTA01	Yes
Sturnus vulgaris	Tech.	> 100 mg/kg	Schafer	1972	00020560	Partial
Agelaius phoeniceus	Tech.	> 100 mg/kg	Schafer	1972	00020560	Partial

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These data indicate that technical captan is practically non-toxic to birds on an acute oral basis. The guideline requirement for an avian acute oral study is fulfilled.

The acceptable subacute dietary toxicity studies are listed below.

Species	% ai	LC_{50}	Author	Date	ID	Fulfills Guidelines Requirements?
Colinus virginianus	Tech	> 2,400 ppm	Hill et al.	1975	00022923	Yes
Coturnix japonica	Tech	> 5000 ppm	Hill et al.	1975	00022923	Partial
Phasianus colchicus	Tech	> 5000 ppm	Hill et al.	1975	00022923	Yes
Anas platyrhynchos	Tech	> 5000 ppm	Hill et al.	1975	00022923	Yes
Colinus virginianus	Unknown	> 4640 ppm	Fink, et al.	1980	00104686	Partially

These data indicate that technical captan is practically non-toxic to birds on a dietary basis. The guidelines requirements for dietary toxicity studies for upland game birds and wild waterfowl are satisfied.

Data addressing potential to affect avian reproduction are required for a pesticide applied on a repeat basis such that it or its metabolites or degradates may be present on a more or less continuous basis, especially preceding or during the breeding season; for stable pesticides, their metabolites or degradates; when such substances may be stored or accumulated in plant or animal tissue; or when adverse reproductive effects are indicated by any other information.

The acceptable avian reproductive studies are indicated below:

Species	% ai	Result	Author	Date	ID	Fulfills Guidelines Requirements?
Colinus viriginianus	Tech	No effect on reproduction at up to 1000 ppm	Chevron (Fink, R.)	1980	00098295	Yes
Anas platyrhynchos	Tech	No effect on reproduction at up to 1000 ppm	Chevron (Fink, R.)	1980	00098296	Yes
Pheasant (unspecified)	90%	No significant differences from controls	Stromberg	1975	00104083	Partially

The studies listed above indicate that technical captan does not impair avian reproduction when exposure occurs via the diet at levels of up to 1000 ppm for up to eleven weeks prior to laying (exposure is to both male and female birds).

Avian LC_{50} studies of formulated products may sometimes be required on a case-by-case basis. However, such special requirements do not apply to captan at this time.

The following is an acceptable LC_{50} study of a formulation with 50% ai captan.

Species	% ai	LC_{50}	Author	Date	ID	Fulfills Guidelines Requirements?
Colinus virginianus	50	> 2510 ppm	Wildlife International	1978	BAOCAP02	Partially

Insufficient data exist to fully characterize the toxicity of the formulation tested to birds. Further studies are not required at this time.

Precautionary Labeling

The available acute, dietary and reproductive data do not indicate a requirement of precautionary labeling for birds on products containing captan.

Effects on Freshwater Fish

Seventeen studies (in seven references) were evaluated under this topic. Fifteen studies were acceptable for use in hazard assessment.

Author	Date	Fiche ID No.
EPA	1979	BAOCAP05
Hermanutz, et al.	1973	00057846
Holland, et al.	1964	BAOCAP08
Johnson and Finley	1980	GS028026
Tooby, et al.	1975	00034713
Dickhaus and Heister	1984	BAOCAP15
Dickhaus and Heister	1984	BAOCAP16

The minimum data required for establishing the acute toxicity of captan to freshwater fish are the results from two 96-hour studies with the technical grade product. One study should be performed on a cold water fish species (preferably rainbow trout) and one study should be performed on a warm water species (preferably bluegill sunfish).

The acceptable acute toxicity data are listed below:

Species	% ai	96-hour LC_{50} (95% ci)	Author	Date	ID	Fulfills Guidelines Requirements?
Lepomis macrochirus	90	0.31 (0.28-0.34) ppm	EPA	1979	BAOCAP05	Yes
Lepomis macrochirus	88.4	0.072 (0.047-0.111) ppm (Flow-through)	Hermanutz et al.	1973	00057846	Yes
Pimephales promelas	88.4	0.065 (0.059-0.072) ppm (Flow-through)	Hermanutz et al.	1973	00057846	Yes
Salvelinus fontinalis	88.4	0.034 (0.022-0.052) ppm (Flow-through)	Hermanutz et al.	1973	00057846	Yes
Salmo gairdneri	90-100	0.073 (0.066-0.080) ppm	Johnson & Finley	1980	GS028026	Yes
Oncorhynchus kisutch	90-100	0.138 (0.118-0.161) ppm	Johnson & Finley	1980	GS028026	Yes
O. tshawytscha	90-100	0.056 (0.052-0.061) ppm	Johnson & Finley	1980	GS028026	Yes

Species	% ai	96-hour LC_{50}(95% ci)	Author	Date	ID	Fulfills Guidelines Requirements?
S. clarki	90-100	0.056 (0.042-0.075) ppm	Johnson & Finley	1980	GS028026	Yes
S. trutta	90-100	0.080 (0.063-0.100) ppm	Johnson & Finley	1980	GS028026	Yes
Salvelinus namaycush	90-100	0.049 (0.040-0.059) ppm	Johnson & Finley	1980	GS028026	Yes
P. promelas	90-100	0.200 (0.168-0.238) ppm	Johnson & Finley	1980	GS028026	Yes
Ictalurus punctatus	90-100	0.077 (0.070-0.085) ppm	Johnson & Finley	1980	GS028026	Yes
L. macrochinus	90-100	0.141 (0.119-0.167) ppm	Johnson & Finley	1980	GS028026	Yes
Perca flavescens	90-100	0.120 (0.097-0.147) ppm	Johnson & Finley	1980	GS028026	Yes
Rasbora heteromorpha	89	0.300 ppm	Tooby et al.	1975	00034713	Partially

The results of the above studies indicate that technical captan is very highly toxic to freshwater fish. The guidelines requirement for acute toxicity testing with freshwater fish is fulfilled.

Data from chronic fish toxicity studies can be required if the pesticide is to be applied directly to water or expected to be transported to water from the intended use site and when other conditions apply, such as 72-5(a)(ii) if any LC_{50} or EC_{50} value determined in testing required by 72-1 is less than 1 mg/l. Since captan is expected to be transported to water in the cranberry use or by runoff/drift and can be applied (via treated rice seed) directly to water, a fish early life-stage study is required.

The acceptable chronic fish toxicity data are listed below.

Species	% ai	MATC	Author	Date	ID	Fulfills Guidelines Requirements?
Pimephales promelas	88.4	> 16.5 < 39.5 ug/l (ppb)	Hermanutz	1973	00057846	Yes

The data indicate that technical captan is chronically toxic to fathead minnows. The requirement has been fulfilled.

Formulated product: Testing of an end-use product is required if the pesticide will be introduced directly into an aquatic environment when used as directed. Since use on cranberries and treated rice seed may directly introduce residues of captan into fresh waters when used as directed, a formulated product acute toxicity test of a freshwater fish is required.

The acceptable formulated product acute toxicity data are indicated below.

Species	% ai	Result	Author	Date	ID	Fulfills Guidelines Requirements?
Salmo gairdneri	50 WP	Total kill at 0.56 ppm in < 24 hrs; 50% kill at 0.32 ppm in 72 hrs. 0.18 ppm is the no effect level. Respiration of treated fish was about 2x that of controls.	Holland, et al.	1964	BAOCAP08	No

Data are insufficient to fully characterize the acute toxicity of 50% formulated captan to freshwater fish. The above data indicate that the 50% ai captan formulation tested is at least highly toxic to rainbow trout. Further study is necessary since the required 96-hr LC_{50} value was not established. The requirement for 96-hr LC_{50} studies of freshwater fish with a formulated product has not been fulfilled.

Precautionary Labeling: The acute toxicity data indicate that precautionary labeling is required for captan products to protect fish. The labeling should include:

This pesticide is toxic to fish.

Effects on Freshwater Invertebrates

Six studies (in six references) were received and evaluated under this topic. Three studies were found acceptable for use in hazard assessment.

Author	Date	Fiche I.D. No.
Cheah et al.	1978	00084745
Boudreau et al.	1980	00070751
Wheeler and Thompson	1978	BAOCAP04
EPA	1979	BAOCAP06
Frear and Boyd	1967	00002875
Dickhaus & Heister	1984	BAOCAP17

The minimum data requirement to establish the acute toxicity of captan to freshwater invertebrates is a 48-hour acute study using technical captan. Test organisms should be first instar Daphnia magna or early instar amphipods, stone flies or mayflies.

The acceptable data for acute studies of freshwater invertebrates are indicated below.

Species	% ai	LC_{50}	Author	Date	ID	Fulfills Guidelines Requirements?
Daphnia magna	Unknown % ai Tech.	48 h. LC_{50} > 7.1 mg/L	Boudreau et al.	1980	00070751	Partially
Daphnia magna	90%	48-h LC_{50} = 8.4 (7.06-9.96) mg/L.	EPA	1979	BAOCAP06	Yes
Daphnia magna	Unknown Tech.	1.3 ppm	Frear & Boyd	1967	00002875	Partially

The above data indicate that technical captan is moderately toxic to freshwater aquatic invertebrates such as Daphnia magna. The Guidelines requirement for an acute toxicity study of technical captan with a freshwater invertebrate is fulfilled.

Precautionary Labeling

The available toxicity data indicate that no special precautionary labeling is required regarding protection of freshwater invertebrates.

Effects on Marine/Estuarine Organisms

One study was received and evaluated under this topic. This study is acceptable for use in hazard assessment.

Author	Date	Fiche ID #
Armstrong et al.	1976	BAOCAP03

Acute toxicity testing with three (3) estuarine/marine species are required to be conducted with the technical grade of the ai to support the registration of an end-use product intended for direct application to the marine/estuarine environment or when such an end-use product is expected to reach the marine/estuarine environment in significant concentrations when the product is used as directed.

Testing of technical grade ai captan will be required for three (3) marine/estuarine species: (1) fish; (2) shrimp; (3) mollusc, because residues are reasonably expected to reach marine/estuarine environments in the treated rice seed and citrus use patterns (see hazard assessments for aquatic organisms).

No acceptable studies have been received for technical captan with marine/estuarine species.

Specialized studies may be required on a case-by-case basis, such as LC_{50} tests of formulated products. While no requirement for such a study exists at this time for captan, the following table contains one such study received and evaluated under this topic.

Species	% ai	Result	Author	Date	ID	Fulfills Guidelines Requirements?
Dungeness crab (Cancer magister)	50	larval 96-hr LC_{50} = 8 ppm	Armstrong et al.	1976	BAOCAP03	No

The available toxicity data are insufficient to fully characterize the acute toxicity of technical captan to marine/estuarine species. The requirements of the Guidelines are not fulfilled.

Precautionary Labeling: No determination as to the appropriate precautionary labeling regarding marine/estaurine species can be made at this time because of insufficient data.

Ecological Effects Disciplinary Review

I. Ecological Effects Profile

A. Manufacturing-use Captan

1. Avian Studies

Acute Oral LD_{50} values of greater than 2000 mg/kg have been found in toxicity studies of both bobwhite quail and mallard ducks (Beavers, 1985, ID # BAOCAP18; Hudson et al., 1984, ID # HCOSTA01). Technical captan used in these studies can therefore be considered practically nontoxic to bobwhite quail and mallard ducks on an acute oral basis. Schafer (1972, ID # 00020560) studied the acute oral sensitivity of passerine species to technical captan. That study found that red-winged blackbirds and starlings had an acute oral LD_{50} > 100 mg/kg. Schafer's data, while not sufficient for a full evaluation of acute oral toxicity, support the conclusions of the studies on upland game and wild waterfowl.

Subacute dietary tests of birds also show relatively low toxicity of technical captan to birds. Hill et al., 1975 (ID # 00022923) found the following eight-day dietary LC_{50} values: bobwhite quail, > 2400 ppm; japanese quail, > 5000 ppm; ring-necked pheasant, > 5000 ppm; mallard duck, > 5000 ppm. These studies show that technical captan is slightly toxic to practically non-toxic to upland birds and waterfowl.

Several studies were available which investigate the potential reproductive effects of technical captan in birds. Chevron, 1980, (ID # 00098295 and ID # 00098296) found that there are no effects on both bobwhite quail and mallard duck reproduction at up to 1000 ppm technical captan fed in diets up to eleven weeks prior to laying. Stromberg (1975, ID # 00104083) also supported this conclusion, although the data collected did not allow a full characterization of the potential reproductive effects. The available studies support the conclusion that captan does not impair avian reproduction when exposures occur via the diet at up to 1000 ppm for prolonged pre-laying periods.

2. Aquatic Studies

Several studies have been made of the acute toxicity of technical captan to freshwater fish. EPA, 1979 (ID # BAOCAP05) found that the 96-hr acute LC_{50} is 0.31 (0.28-0.34) ppm when tested with bluegill sunfish. Hermanutz et al., 1973, (ID # 00057846) found the LC_{50} = 0.072 (0.047 to 0.111) ppm for the

same species. That study also tested fathead minnows and brook trout and found LC_{50} values of 0.065 (0.059-0.072) ppm and 0.034 (0.022-0.052) ppm, respectively. All three exposures in the Hermanutz et al. 1973 study were flow-through, acute, 96 hrs.

Johnson & Finley, 1980 (ID # GS028026) tested several freshwater fish in 96-hour acute (static) exposures and found the following LC_{50} values for technical captan of 90-100% ai purity: rainbow trout, 0.073 (0.066-0.080) ppm; Coho salmon, 0.138 (0.118-0.161); chinook salmon, 0.056 (0.052-0.061) ppm; cutthroat trout, 0.056 (0.042-0.075); brown trout, 0.080 (0.063-0.100) ppm; lake trout, 0.049 (0.040-0.059) ppm; fathead minnow, 0.200(0.168-0.238) ppm; channel catfish, 0.077 (0.070-0.085) ppm; bluegill sunfish, 0.141 (0.119-0.167) ppm; yellow perch, 0.120 (0.097-0.147) ppm.

The available data indicate that technical captan is very highly toxic to both cold water and warm water fish species in acute exposures.

Hermanutz et al. (1973; ID # 00057846) studied chronic toxicity of technical captan to fathead minnow (P. promelas). The MATC (estimated for a 45-week exposure period) was > 16.5 < 39.5 ppb. This value is based on observed effects on survival and growth. Adverse effects on spawning, while suspected to occur at 16.5 and 39.5 ppb, were not statistically demonstrated.

Several authors described acute toxicity studies of Daphnia magna with technical captan. Boudreau et al. (1980; ID # 00070751) found a 48-hr LC_{50} > 7.1 mg/l (technical). EPA (1979; ID # BAOCAP06) found a 48-hr LC_{50} = 8.4 (7.06-9.96) mg/l (90% ai) indicate that technical captan is moderately toxic to the freshwater invertebrate, Daphnia magna.

B. Formulated Products with Captan

1. Avian Studies

50% ai

A study of subacute dietary toxicity with bobwhite quail and a 50% ai formulation (ORTHOCIDE®) (Wildlife International, 1978; ID No. BAOCAP02) indicated an LC_{50} > 2150 ppm. These data suggest that 50% captan formulation could be no more than slightly toxic to upland game species such as quail.

2. Aquatic Studies

50% WP

Holland et al., 1964 (ID # BAOCAP08) described reactions of rainbow trout to a 50WP. Total kill was obtained at 0.56 ppm in less than 24 hours; 50% kill was observed at 0.32 ppm in 72 hours; 0.18 ppm was thought to be a no-effect level. The respiration of treated fish was reported to be 2x that of the controls.

A study of a 50% ai product was made of the dungeness crab, Cancer magister. Armstrong et al., 1976 (ID # BAOCAP03) found a 96-hr LC_{50} = 8 ppm for crab larvae.

II. Ecological Effects Hazard Assessment

Captan is a contact fungicide used against a broad spectrum of plant-pathogenic fungi. It is currently registered as a fungicide in agricultural use for foliar applications to fruit, vegetables, nut and ornamental crops. It is also used in pre-planting soil treatments and postharvest treatments of many fruits and vegetables.

Other uses of captan include produce packing boxes, greenhouse soils and crops, house plants, home gardens, house pets (in flea powder) and powdered hand soaps. In industrial applications it is registered as a plastics preserver, in oil-base paints, wall paper paste, textiles, paper and in cosmetics.

Technical products are produced in the 90% ai range. Formulation intermediates are 45-93% ai. Various single active ingredient formulations are available including: 5-90% dusts; 80% water dispersible granular; 25-80% wettable powders (with 50% WP being a widely used formulation); 5-7% wettable powder/dusts; 13-38.5% flowable concentrates; 18.9% ready-to-use liquids; and a 4% pressurized liquid.

In its major use captan would typically be applied as a spray to tree fruit. Apples in the East and Central U.S. account for 29% of the ai use. About 35% of apples are treated each year. Peaches (nationwide) account for about 11% of the captan ai use (about 65% of peaches are treated annually). Other significant (> 6% of the ai use) uses are: almonds (9%), strawberries (8%). (Figures for cranberries were not available.)

Seed treatments constitute the next major use and include: corn; cotton; sorghum; soybeans; peanuts, rice (<1 % of ai use ; 10% of crop treated annually); small grains; potatoes; and vegetables.

All other agricultural uses and industrial or home uses constitute less than about 5% of all ai produced. Of these turf (< 1.1 % of ai use) receives about 24,000 lbs ai/year (10-35% of the crop).

In the fruit tree use, the fungicide is applied as a spray prepared from WP's, FC's, or water dispersible granulars by use of ai blast sprayers. Aerial application is also used for foliar applications; also tractor mounted dusters are used. In seed treatments captan can be applied by seed planting equipment modified to apply dusts or sprays to seed planting furrows.

Foliar treatments to fruits, nuts and vegetables are usually made at 1.0 to 1.5 lbs ai/Acre (lbs ai/100 gallon). However cherries and notably citrus can be treated with up to 2.0 lb ai/A. Quince may be treated with 5 lbs ai/A to control brown rot (Manilinia) and scab (Venturia). Potatoes are recommended to receive 2 to 4 lbs ai/A for blights and tomatoes - 2.0 lbs ai/A for blights, Leaf Spot, and Anthracnose. Cranberries are treated at 1.0 lb ai/A. Cotton is treated at 4.0 to 6.0 lbs ai/A; soybeans at 2.0 to 6.0 lb ai/A. Corn at 6.0 lbs ai/A.

Soil treatments - These application rates range from 1.0 lb ai/A for melons and squash to 50.0 lb ai/A for taro in Hawaii. Typical soil treatments are 2 to 6 lbs ai/A. Seed treatments range from 0.2 to 16.0 lbs ai/100 lb. Seed is treated with typical rates of 0.4 to 3.0 lb ai/100 lb seed. Rice seed is treated at 0.9 to 3.75 lb ai per 100 lb seed.

Terrestrial Species

Acute oral toxicity determinations (LD_{50} studies) on upland game species and wild waterfowl indicate that captan is practically nontoxic to these birds. Supporting data on passerine species also show low toxicity on an acute oral basis. Dietary toxicity data (LC_{50}) for upland and waterfowl species also indicate that captan is practically nontoxic to birds on a dietary basis.

Mammalian toxicity data derived from studies of laboratory mammals show that on an acute oral basis captan is practically nontoxic to rats (8400 to 12,600 mg/kg). However rats in a poor nutritional condition (low protein intake) can be very sensitive to captan - the LD_{50} reduced to 479 mg/kg in a protein deprivation experiment with captan.

Chronic dietary studies on rats indicate the compound is practially nontoxic in a dietary exposure (LC_{50} > 5,000 ppm). However chronic exposures at 5000 to 10,000 ppm result in suppression of weight in rats.

Based on one test, cattle seem to be more sensitive to captan than some other mammalian species. Six doses of 250 mg/kg/day produced lethality. Also sheep were poisoned by single doses of 250 mg/kg or higher. However, these studies were of a systemic poisoning via dosing syringe and do not necessarily indicate an environmental hazard for these species.

For terrestrial species the following maximum residues expected on a variety of dietary matter immediately after one application at the indicated rates would be:

Table 1. Projected Residues
ppm

	1 lb ai/A	4 lb ai/A	10 lb ai/A
Short grass	240	950	2400
Long grass	110	450	1100
Leafy crops	125	520	1250
Forage, small insect	58	230	580
Pods, large insect	12	45	120
Fruit	7	26	70

Based on the available data for terrestrial wildlife species the above projected residues do not appear to represent a significant dietary toxicological hazard.

Captan's use on taro (restricted to Hawaii) is a small but potentially heavy use. The pesticide can be applied as a single preplant, soil treatment at up to 50 lbs ai/A. (Taro is grown on Hawaiian mud flats.) The residues resulting from such a heavy application are projected as: 520.5 mg per sq foot or 1,100 ppm in top 0.1 inch of soil. Residues on insects could be used to estimate dietary residues on food items for small mammals such as shrews and bats, and for insectivorous birds (passerine species). Residues resulting from a 50 lbs ai/A application to soil could be between 600 and 2,900 ppm, depending on the size of the insects. (Assume a 50-50 mix; average residue = 1750 ppm).

Shrew and bats are both small mammals whose relatively large surface area /volume ratios (S/V). Essential functions such as maintainence of body temperature (over 90 % of oxidative energy expenditure) becomes extremely difficult with a large S/V ratio. Moreover bats expend very large amounts of energy in flight. Thus these species must consume an extremely high proportion of their body weights each night of insect food (Some shrews such as Sorex cinereus consume as much as 330% of the weights each night). For a conservative assessment one can assume food consumption of about 50% of body weights for both shrews and bats. Using a 15g body weight (medium to large shrew, but a small bat - such as the endangered Hawaiian Hoary Bat), up to 0.0075 kg of insects could be expected to be taken in an acute exposure (one night of feeding immediately after application of fungicide).

The mg of pesticide ingested can therefore be calculated by,

$$(.0075\text{Kg}) \times (1750 \text{ ppm})$$

$$= \quad 13.125 \text{ mg.} \qquad (1)$$

Using 8400 mg/kg as the small mammal LD 50, a lethal acute dose is,

$$(8400 \text{ mg/kg}) \times 0.015 \text{ kg}$$

$$= \quad 126 \text{ mg.} \qquad (2)$$

Endangered species review is triggered by 1/10 LD 50 or 12.6 mg. "RESTRICTED" use label is not triggered ($\geq$ 1/5 LD 50 < LD 50).

A similar assessment for seed-eating and insectivorous passerine bird species feeding in treated taro can be made. Residues on food items are considered as 1750 ppm for a 50-50 mix of insect sizes, while seeds would contain up to 600 ppm. The LC 50 is 5000 ppm (conservative). A finch-like bird (13 g) eating about 45% of its body weight (5.9 g) per day ingests an acute dose of 10.3 mg pesticide if 100% insects are eaten, and only 3.5 mg pesticide if 100% seeds are consumed. These amounts are far below acute oral LD 50 (> 2000 mg/kg), however, since avian triggers are calculated based on the LC 50 > 5000 ppm, it is apparent that residues on food items could exceed the endangered species trigger for birds (1/20 LC 50 = 250 ppm if the LC = 5001 ppm). Since the actual LC 50 is likely to be considerably greater than 5000 ppm (based on other avian and mammalian toxicity information) it is unlikely that the RESTRICTED use label trigger (1/5 LC 50 > 1000 ppm) would be exceeded.

Directions for some uses (other than taro) indicate that repeat applications may be made. Available environmental chemistry data indicate that captan rapidly degrades in soil (yet fungicidal activity can last up to 3 weeks). At this time we do not expect an accumulation of residues on dietary items of terrestrial wildlife beyond single dose residue levels projected in Table 1.

Available data on potential reproductive effects in birds indicate that no effect on upland game nor wild waterfowl reproduction is expected at dietary levels of up to 1000 ppm. Treatments to cotton are routinely considered when assessing potential for reproductive effects in birds. Captan allows use on cotton seedlings for "damping off". In this use however, only one treatment at planting, to soil is allowed. This treatment is not expected to result in residues exceeding "no-effect" (no impairment) levels in available avian reproduction studies.

Freshwater Species

The available data on technical captan indicate that it is very highly toxic to freshwater fish but only moderately toxic to aquatic invertebrates as represented by Daphnia magna (waterflea). Freshwater fish acute toxicity is estimated by static bioassay to be as low as LC_{50} = 56 ppb. Flow-through acute studies of freshwater fish show that acute toxicity is as low as 34 ppb (22 to 52 ppb). The chronic toxicity of captan (88.4% ai) in a flow-through freshwater system was estimated by testing fathead minnow growth, survival and reproduction. An MATC value > 16.5 < 39.5 ppb was estimated.

Acute toxicity resulting from captan occurs rapidly as indicated by static and aged static LC_{50} studies of fathead minnows (Hermanutz et al. 1973; 00057846). When a group of fatheads (Pimephales promelas) was exposed to 550 ppb (fresh toxicant) all died within 8 hours. A second group placed in the same vessels three hours later survived without any effects observable for 10 days. In another trial a group of 10 was exposed to 500 ppb (fresh toxicant). Sixty percent died within 7 hours. All fish were affected, exhibiting "feeble swimming" and surfacing. The forty percent surviving this exposure completely recovered and returned to "normal" for the duration of this 10-day exposure. Because captan (soluble at 0.5 ppm in water) is thought to rapidly hydrolyze (especially at pH > 7) the fathead minnow study provides some useful insight into potential effects of exposure to hydrolysis products. With a hydrolytic half-life of only a few hours it appears that mortality results from only a few hours exposure to parent captan or to parent plus the initial hydrolysis products (which we consider primarily to be a ringed structure, tetrahydrophthalimide,or THPI, and a trichloromethylthio side chain moiety, or

TMT). At this time the toxic potential of TMT is unclear with respect to mammalian tests, and may be implicated in certain oncogenic observations. The Agency is requesting additional information on the fate of the TMT moiety. Additional ecological effects studies on TMT or other hydrolytic products of captan may be required pending a review and evaluation of this inquiry.

Since captan is soluble at levels well above those causing effects in laboratory studies of fish, the Agency considered the potential for aquatic contamination resulting from registered uses. Available environmental chemistry data did not suggest a high potential for captan to leach or runoff from agricultural fields. The Agency considers that captan's use as a rice seed treatment and as a foliar treatment for cranberries and citrus represent reasonable expectations that freshwater systems could become contaminated. Rice and cranberry are subject to extensive water management practices, which could lead to the flushing of of captan residues from treated fields into ponds and streams. Aerial cranberry treatments as well as mist blower treatments of citrus present a potential for drift of toxic residues.

Since use on cranberries and treated rice seed may introduce captan or degradation products into aquatic systems when used as directed, an acute study of formulated captan product is necessary. Holland et al. (1964; BAOCAP08) found that a 50 WP formulation killed all rainbow trout exposed to 560 ppb in less than 24 hours. A 72-hr LC_{50} was estimated as 320 ppb. No effect was noted at 180 ppb. These data, while not sufficient to fully characterize the acute toxicity of a 50% ai product, indicate that the formulation is very highly toxic to rainbow trout.

Rice Seed Treatments

Rice production is concentrated in coastal regions of southwestern Louisiana and southeastern Texas and eastern Arkansas and northwestern Mississippi. The rice areas of Texas and Louisiana are innervated by numerous bayous that not only provide drainage basins for the flat coastal area but also serve as major nursery grounds for commercially important shrimp, crab, and fish species in addition to other aquatic organisms. In Arksansas and Mississippi, the rice fields are drained by rivers and streams that serve as water sources for commercially important crayfish and channel catfish farms.

The extent of rice crops in Texas, Louisiana, Mississippi, and Arkansas in 1974 and 1975 were: 600,000 acres in Texas, 850,000 acres in Arkansas, 645,000 acres in Louisiana and 122,000 acres in Mississippi.

Seed beds in fields designated for rice are normally prepared during February and March. The fields are worked between the weather fronts characteristic of the season when the fields have dried adequately to permit machinery to operate. Usual seeding dates are mid-March (Texas) or mid-April through early June. Rice is most commonly drill seeded or broadcast by air and lightly disced.

It is difficult to estimate the extent to which rice fields would be directly contaminated by treated seed because residues cannot be accurately estimated on a pound ai/A basis. Rice seed is treated with captan at a rate of 0.9 to 3.75 lb ai/100 lb of seed. Seed is broadcast in wet seeding operations by air at about 140 lbs seed per acre. In an extreme "worst-case" all residues are retained on treated seed until planting. Initial captan residues in a 6-inch acre layer of water (flooded rice field) would range from 900 to 4000 ppb.

The "worst-case" residue estimates exceed RPAR criteria for freshwater fish. However, at this time the Agency does not reasonably expect that "worst-case" estimates will be realized with treated rice seed use. Only a fraction of the amounts applied is expected to be retained on treated rice seed prior to use. In a previous review of the risks and benefits associated with the use of captan, the Agency required that registrants submit residue data to determine actual residue levels for food crops. Also, the Agency required that registrants submit residue data for seed treatment uses, to establish tolerances and to determine whether the residues, if detectable, are of concern. When these data are available the Agency will be in a position to more accurately estimate the potential for aquatic contamination by these residues. Until then, a more accurate assessment of the aquatic hazard will not be possible for rice seed treatments.

Cranberries: (25,000 acres) Treated at 4.0 lb ai/A for blotch rot (up to 25 ppm). Twig blight (up to 25 ppm).

4.0 lb ai/A applied to 6-inch acre-layer of water = 2936 ppb initial residue. The extensive use of water for flooding the cranberry crops is limited to the northeast U.S. for winter flood crop protection. Pacific NW area growers do not flood crop in the winter. However almost all of the crop is flooded before or at harvest time because of harvest practices. Gradual release of the floodwater could carry residues downstream. Spinkler irrigation systems are used on almost all of the eastern and western (Pacific NW) crop.

It is probable that even with a maximum application of 1.0 lb ai/A followed by a frost protection flood, e.g., in New Jersey, that rapid hydrolysis of captan would occur prior to the release of flood waters downstream. Therefore, any downstream levels of captan are expected to be less than 734 ppb assumed for a 6-inch deep acre flood.

Spray drift and/or runoff from cranberry applications could also result in contamination of significant aquatic resources found in the immediate area of cranberry bogs. Assuming a worst-case drift scenario of 20% of the amount applied (0.8 lb ai/A) we would expect 600 ppb as the initial residue in a 6-inch acre flood (here representing a cranberry bog) or half that amount (300 ppb) in a one-acre flooded bog. These levels exceed special review (RPAR) triggers for freshwater fish (> 1/2 LC 50 = 17 - 36 ppb, depending on species). The Agency does not expect these worst-case values to be realized in actual use. Comparisons to exposure models (EEC) for a similar cranberry fungicide indicate that levels are expected to be below that predicted for the worst-case. Adjusting for application rate only, the EEC due to drift and runoff was modelled as 240 ppb at 100 feet downwind in a 10 mph crosswind - aerial application (SWRRB and EXAMS models with EAB/HED drift "ballistic" model). Again, these values, although inferred from a different but similar cranberry fungicide, exceed special review (RPAR) triggers for freshwater fish.

Due to the highly toxic nature of captan to fish, an EEC must be obtained, specifically calculated for captan, prior to completing the assessment of hazard for aquatic organisms. It is posssible that special review triggers will be exceeded by use on cranberries.

CITRUS

Florida -

Maximum citrus acreage is located in Florida. Over 70% of the U.S. orange and grapefruit acreage (700,00 A) are located there. Citrus groves can geographically subdivided into two types: Central (a greater production of citrus per county); and Coastal. Central counties have numerous lakes, thought to have formed from ancient sinkholes. Florida Dept. of Environmental Regulations (DER) characterizes the groves there as having fine sandy soil on hilly terrain, with good drainage (some groundwater drainage into lakes is expected). Groves may be planted to lake's edge; some have rim ditches or marsh buffers. Buffers of less than 30 yards are common.

Florida Dept. of Environmental Regulation (DER) expects little or no surface runoff from the hilly groves of the central area, but movement through the sand could contaminate lakes and connecting rivers. Soils and hydrosoils are of low organic matter content, thus organically bound chemicals may be moving through with little impedement. DER doubts any extensive use of tile and/or ditch drainage systems in the central state groves because they are expensive and unecessary there.

The coastal groves are subject to rainy and dry seasons, which determine whether groves may have to be pumped-drained or irrigated. The rainy season coincides with most pesticidal applications and pump drainage of groves can be expected. Most groves have ditch-drainage. Ditches empty directly into canals and ultimately into the Intercoastal Waterway.

Ditches and canals of the coastal groves may be characterized by heavy "muck" (organic) soils and hydrosoils, thus favoring retention of organically bound chemicals. They support amphibians, reptiles and fish including largemouth bass, bluegill, killifish and mosquitofish, among others. Aquatic invertebrates there are of course basic to these food chains.

Other Citrus Areas -

California and extreme S.E. Texas are two other areas of extensive citrus acreage . In California, many man-made bodies of water such as canals, ditches, and reservoirs are important aquatic resources in citrus growing areas. In Texas, freshwater resources include the Rio Grande River, several reservoirs, and agricultural canals. Citrus drainage eventually provides potential exposure of Gulf of Mexico estuarine areas such as the Laguna Madre, South Bay, and Laguna Atascosa.

The citrus grove scenarios discussed represent significant opportunity for aquatic contamination through spray drift, direct application, surface runoff, and ground water drainage, or leaching. As with the cranberry crop, the highly toxic nature of captan to aquatic organisms has raised a distinct concern for potential ecological effects. In attempting to quantify some of these effects we can assume a worst-case drift factor of 20% of the amount applied (0.8 lb ai/A) directly enters a 6-inch acre layer of water. We would predict initial residues of 600 ppb or about 50 ppb in six-acre foot of water. These levels exceed special review (RPAR) triggers for freshwater fish (> 1/2 LC 50 = 17-36 ppb). The Agency, however, does not expect worst-case figures to be realized in actual use. Comparisons to exposure models (EEC) for a similar citrus fungicide indicate that levels are expected to be below that predicted for the worst case. Adjusting for application rate only, the EEC due to drift and

runoff was modelled as 0.6 ppb in a nearby pond 50 feet downwind. This value does not exceed endangered species trigger for fish 1/20 LC 50 = 0.85 - 1.8 ppb). However, because of the uncertainties of extrapolating model EECs from one fungicide to another (discussed in the cranberry use pattern analysis) we are requesting that the Exposure Assessment Branch/HED calculate a specific EECs for

Marine/Estuarine Species

The aquatic risk assessment for freshwater organisms is applicable to marine /estuarine species exposed by treated rice seed and citrus uses since both uses are prevalent within coastal areas. Treated rice seed particularly may provide residues which could drain directly into important fish and shrimp nurseries in the Gulf coastal rice growing counties of the southeast and central U.S.

The Agency will be requiring both acute toxicity studies of marine/estuarine fish (no data available on the technical ai) and the residue data for rice seed (a result of a previous risk/benefit analysis).

Endangered Species

Rice and cranberries have not been previously evaluated under EEB's endangered species program. To completely evaluate the potential effects of captan's use as a fungicide on endangered species, EEB needs the exposure asssesment results from specific captan drift and runoff EEC models for cranberries. EEB must also evaluate the residue data required for treated rice seed by a previous risk/benefit analysis (Captan PD 2/3) in order to evaluate potential for risk to endangered aquatic organsims in this rice.

EEB obtained an "endangered species" opinion from U.S.D.I for a similar fungicide, which included use on citrus. Exposure of endangered species in citrus included two bird species (which would be jeopardized through damage to their fish or aquatic snail prey species), one freshwater fish and three insect species. EEB will await the results of modelling by the Exposure Assessment Branch/HED prior to making a determination as to whether use of captan on citrus may affect these species.

The trigger for protection of endangered mammals is exceeded by use of captan on taro in Hawaii at 50 lb ai/A. Listed mammals in Hawaii include only the Hawaiin hoary bat, Lasiurus cinereus semotus. Consultation with the U.S.D.I., Office of Endangered Species, under Sec. 7 of the Endangered Species Act, is indicated for this use, in order that apprropriate action or labeling may be recommended.

Captan was identified by the "cotton cluster" endangered species biological opinion (11/12/83) as jeopardizing listed fish and freshwater mussels . This includes use on cotton and soybean crops but not seed uses for cotton or soybeans.

III. Precautionary Labeling

A. Manufacturing-use Products

"This pesticide is toxic to fish. Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans or public water unless this product is specifically identified and addressed in an NPDES permit. Do not discharge effluent containing this product to sewer systems without previously notifying the sewage treatment plant authority. For guidance contact your State Water Board or Regional Office of the EPA."

B. Outdoor Uses

1. Seed Treatments

"This pesticide is toxic to fish. In the event treated seeds are spilled, collect or cover completely. Do not contaminate water by cleaning of equipment or disposal of wastes."

2. Cranberries + taro

"This pesticide is toxic to fish. Drift or runoff from treated areas may be hazardous to aquatic organisms in neighboring areas. Do not contaminate water by cleaning of equipment or disposal of wastes."

3. All other Outdoor Uses

"This pesticide is toxic to fish. Do not apply directly to water or wetlands. Drift and runoff from treated areas may be hazardous to aquatic organisms in neighboring areas. Do not contaminate water by cleaning of equipment or disposal of wastes."

4. Endangered Species Precautions

_____(Subject to additional precautionary labeling which may result from forthcoming consultations as required by "endangered species section" of this chapter).

"ENDANGERED SPECIES RESTRICTIONS

It is a violation of Federal laws to use any pesticide in a manner that results in the death of an endangered species or adverse modification of their habitat.

The use of this product may pose a hazard to certain Federally designated endangered species known to occur in specific areas within the following counties:

STATE Species (BULLETIN NO.)	COUNTY
ALABAMA Slackwater Darter (EPA/ES-85-05)	Lauderdale Limestone Madison
NEW MEXICO Pecos gambusia (EPA/ES-85-)	Chaves Eddy
TENNESSEE Slackwater DARTER (EPA/ES- 85- 04	Lawrence Wayne
Freshwater Mussels (EPA/ES- 85-07)	Hancock Claiborne Hawkins Sullivan
TEXAS Pecos gambusia (EPA/ES-85-)	Reeves Jeff Davis Pecos
Commanche Springs Pupfish (EPA/ES-85-)	Reeves Jeff Davis
VIRGINIA Freshwater Mussels (EPA/ES -85-06)	Smyth Scott Lee Washington Grayson

Before using this product in the above counties you must obtain the EPA Bulletin specific to your area. This Bulletin identifies areas within these counties where the use of this pesticide is prohibited, unless specified otherwise in the Bulletin. The EPA Bulletin is available from either your County Agricultural Extension Agent, the Endangered Species Specialist in your State Wildlife Agency Headquarters or the appropriate Regional Office of the U.S. Fish and Wildlife Service. THIS BULLETIN MUST BE REVIEWED PRIOR TO PESTICIDE USE. Call 1-800-000-0000, toll free, if you have any questions or cannot obtain the approriate bulletin. "

IV. DATA GAPS

See the attached Generic Data Requirement Tables.

TABLE A
GENERIC DATA REQUIREMENTS FOR CAPTAN

Data Requirement	Composition[1]	Use Pattern[2]	Does EPA Have Data To Satisfy This Requirement? (Yes, No or Partially)	Bibliographic Citation		Must Additional Data Be Submitted Under FIFRA Section 3(c)(2)(B)[3]
158.145 Wildlife and Aquatic Organisms						
Avian and Mammalian Testing						
71-1 Avian Oral LD_{50}	TGAI	A,B,C,E, F,G,H,I[4]	Yes	GS0122045[8] 00020560[9]	GS0122046[8]	No
71-2 Avian Dietary LC_{50}						
a. waterfowl	TGAI		Yes	00022923[8]		No
b. upland game	TGAI	I[4]	Yes	GS0122047[9] 00022923[8]	0014686[9]	No
71-3 Wild Mammal Toxicity	TGAI	A,B	No			No
71-4 Avian Reproduction						
a. waterfowl	TGAI	A,B,C	Yes	00092896[8]		No
b. upland game	TGAI	A,B	Yes	00098295[8]	00104083[9]	No
71-5 Simulated and Actual Field Testing for Mammals and Birds	TEP	A,B,C	No			No
Aquatic Organism Testing						
72-1 Freshwater Fish LC_{50}						
a. warmwater	TGAI	A,B,C,E, F,G,H	Yes	GS0122042[8] 00034713[9]	GS0122043[8] 00057845[8]	No
	TEP (50%)	C	No			Yes (6 months)
b. coldwater	TGAI	A,B,C,E,F,G,H,I[4]	Yes	00057846[8];	GS0122043	No
	TEP (50%)	C	No			Yes (6 months)
72-2 Acute LC_{50} - Freshwater Invertebrates	TGAI	A,B,C,E,F,G,H,I[4]	Yes	00070751[9]; 00002875[9]	GS00122041[8]	No
	TEP (50%)	C	No			Yes (6 months)

TABLE A
GENERIC DATA REQUIREMENTS FOR CAPTAN

Data Requirement	Composition[1]	Use Pattern[2]	Does EPA Have Data To Satisfy This Requirement? (Yes, No or Partially)	Bibliographic Citation	Must Additional Data Be Submitted Under FIFRA Section 3(c)(2)(B)[3]
72-3 Acute Toxicity - Estuarine and Marine Organisms					
a. fish	TGAI	A,C	No		Yes[5] (6 months)
b. shrimp	TGAI	A,C	No		Yes[5] (6 months)
c. oyster	TGAI	A,C	No		Yes[5] (6 months)
72-4 Fish Early Life Stage and Aquatic Invertebrate Life-Cycle	TGAI	A,C	No		No
72-5 Fish Life-cycle	TGAI	A,C	Yes	000578468/	No
72-6 Aquatic Organism Accumulation	TGAI PAI or Degradation Product	A,C	No		Yes[6] (1 year)
72-7 Simulated or Actual Field Testing - Aquatic Organisms	TEP	A,C	No		Yes[7]

FOOTNOTES TO TABLE A - WILDLIFE AND AQUATIC ORGANISMS

1/ Composition: TGAI = Technical grade of active ingredient; PAI = pure active ingredient; TEP = typical end-use product.

2/ The use patterns are coded as follows: A = Terrestrial, Food crop; B = Terrestrial, Nonfood crop; C = Aquatic, Food crop; D = Aquatic, Nonfood crop; E = Greenhouse, Food crop; F = Greenhouse, Nonfood crop; G = Forestry; H = Domestic Outdoor; I = Indoor.

3/ Data must be submitted no later than indicated below.

4/ To support the MUP when use includes "Indoor."

5/ Data are required because the rice seed and citrus use patterns encompass greater than 300,000 acres in coastal counties of the U.S., therefore creating potential to impact marine/estuarine organisms.

6/ Refer to the requirements for environmental fate chapter.

7/ Protocols addressing this requirement are to be submitted to the Agency within three (3) months. Protocols must receive written Agency approval prior to conducting such studies. The date when the data are to be submitted will be determined by the Agency based on the protocols and will be given in the review of the protocols.

8/ Study fulfills guideline requirements when considered alone.

9/ Study must be combined with other studies to fulfill guideline requirements.

Most Recent
Revision
10/31/85
Captan Data
Tables